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AUTHOR House, Peggy A.; Moore, Arnold J.
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ABSTRACT

Previous research studies have established that students' academic achievement can be directed from their self-concepts of academic ability and from selected characteristics of the learning environment. The present study provides evidence for the relationships between learning environments and academic self-concepts, and it demonstrates that, for ninth-grade mathematics students, both general and mathematical self-concepts of academic ability can be predicted from combinations of classroom environment characteristics. This in turn provides a rationale for additional research to determine if it is possible to enhance self-concepts through providing suitable learning environments and thereby to increase academic achievement. (Author)

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THE LEARNING ENVIRONMENT AS A PREDICTOR OF THE ACADEMIC SELF-CONCEPTS OF NINTH GRADE MATHEMATICS STUDENTS

by

Dr. Peggy A. House
Assistant Professor
Department of Mathematics Education
University of Minnesota

Dr. Arnold J. Moore
Dean, School of Education
Youngstown State University

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of the
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THE LEARNING ENVIRONMENT AS A PREDICTOR OF THE ACADEMIC SELF-CONCEPTS OF NINTH GRADE MATHEMATICS STUDENTS

Introduction

A decade ago, Brookover proposed that significant numbers of students were being needlessly hindered in academic achievement by their low self-concepts of academic ability. He theorized that this self-concept of ability functioned as a threshold variable setting limits of achievement for the individual.

If one accepts this Brookover postulate, then a logical conclusion is to seek means of enhancing the academic self-concept -- that is, the student's perception of his ability to achieve in school tasks -- in the concomitant hope of subsequently increasing achievement. To this end it is reasonable to search for those factors or conditions which tend to influence the self-concept of academic ability and to investigate whether changes in these contributors will produce the desired effect on self-concept.

In the longitudinal study conducted by Brookover and his associates, the researchers documented the change in self-concept associated with the individual's perception of the evaluations which certain significant others held of the student. They established that students' self-concepts of academic ability were significantly related to school achievement and that increases in self-concepts were accompanied by increases in achievement.

Another group of research studies, by Walberg and his associates, also investigated factors related to school achievement. The data these obtained indicated that certain characteristics of the classroom learning environment could be used to predict academic achievement. Consequently, it seemed logical to assume that the learning environment might also be a predictor of self-concept. It was this broad hypothesis that served as the basis for the study described in this paper.

The underlying theory for the research reported here is a composite and a modification of the theories of Brookover and Walberg. It proposes that a student's perception of the classroom climate contributes to a self-concept of academic ability and thereby affects achievement indirectly through the student's self-concept.

Previously, an instrument had been developed by Brookover to assess the self-concept of academic ability where self-concept of academic ability is taken to mean behavior in which one indicates to oneself, publicly or privately, one's ability to achieve in academic tasks as compared with others engaged in the same task. Likewise, Walberg and his associates developed the Learning Environment Inventory (LEI) to measure interpersonal relationships among pupils, relationships between pupils and teachers, relationships between pupils and both the subject studied and the method of learning, and the pupils' perceptions of the structural characteristics of the class. Items in the LEI were designed to yield fifteen scales. Among these, cohesiveness, friction and competitiveness related most closely to the assessment of pupil-pupil relationships; formality, favoritism, disorganization and democracy to pupil-teacher relationships; diversity, speed, satisfaction and difficulty to pupil-subject-method relationships; and environment, goal direction, cliqueness and apathy to structural characteristics of the class.

Individually, the Brookover and Walberg instruments have each demonstrated a capability to be a significant predictor of academic achievement. A central purpose of the present study was to determine if scores on the LEI would predict scores on a Brookover type self-concept of academic ability scale. Such a relationship, if established, could then suggest further research on the possible effect of the classroom climate on academic self-concept and subsequent learning outcomes.

Design and Methodology

The subjects for this study were 1079 ninth grade algebra and general mathematics students enrolled in 15 Kansas and Nebraska junior and senior high schools. The schools were selected to represent a range in size from under 200 students to over 1500 students. Further, the schools were to embody different organizational patterns with respect to the number and level of grades in the school. These different kinds of schools were included for two reasons: First, it is possible that school size might influence scores on the LEI, especially those scales measuring cohesiveness, diversity, formality, cliqueness and the like. Second, it had been suggested by Bloom that the environment is likely to exert its greatest influence at periods of most extreme change, such as entrance to a new level of education. Hence, whether one attended a junior or a senior high school might be significant. In addition, participants were selected from both algebra and non-algebra courses where non-algebra courses were taken to be all those curricula which were non-college preparatory in nature although these courses were variously titled as "general math", "pre-algebra", "topics of algebra", "mathematical foundations", etc.

Since the study focused on mathematics students and because Brookover has demonstrated that general academic self-concept is distinct from self-concept of ability in specific subjects, two forms of the self-concept instrument were used to obtain data: the general self-concept of academic ability (SCA) scale and the self-concept of ability in mathematics (SCAM) scale. This procedure provided two different though related self-concept scores for each student. The LEI provided data on 15 dimensions of the classroom environment with a score on each scale for each subject. In addition, five student characteristics were recorded as dichotomous variables for each individual.

First, the course (algebra or non-algebra) was noted because the course in which a student is enrolled may be related to his perception of the evaluations which others hold for him. This is especially likely in mathematics classes where enrollment in algebra is commonly assumed to imply that the student has the potential to succeed in college preparatory mathematics course. Enrollment in non-algebra courses generally carries the opposite connotation.

The level of school organization also was considered since, as indicated earlier, Bloom had postulated that environments exert their greatest influence at periods of most extreme change. Thus, a student enrolled in a senior high school may be affected by the learning environment differently than a student in a junior high school. Also, in keeping with the model of the class as a social system, classes may be influenced by the size of the school. In particular, in schools with small enrollments students are more likely to have several classes together or to be with the same students for several years. They also have greater opportunity to develop personal relationships with teachers or fellow students. Since all of these factors may be influential, school size also was recorded.

The sex of the student was likewise included as a variable because the Brookover study indicated that sex should be controlled when using the SCA to predict learning. Finally, whether or not a student had his present mathematics instructor as a teacher in any previous course also was recorded. The rationale for this inclusion was the possibility that teachers with whom students had more extended contact might have greater influence as significant others in the student's life. It should be noted, however, that since neither Brookover nor Walberg reported significant influences on the part of either IQ or socio-economic class in the ability of the SCA and the LEI to predict school achievement, no attempt was made to assess these variables in the present research.

Thirty-two null hypotheses were developed to test the generalized hypothesis that no scale or combination of scales from the LEI could significantly predict either SCA or SCAM scores of ninth grade mathematics students when one or more of the dichotomous variables were controlled. The data were analyzed by the multiple regression technique which utilizes two or more independent variables to predict a single dependent criterion. Five applications of the multiple regression technique were involved, the first four controlling in turn course, school level, school size and sex; the last simultaneously controlling course, school level and size.

In each analysis, an initial attempt to predict the criterion (SCA or SCAM) was made using as predictors the fifteen LEI scales and those dichotomous variables which were not being controlled. From an analysis of the regression coefficients produced for the above full model equation, the most important variables could be identified and used as predictors for a new restricted model equation having the same criterion. The predictions made by both full and restricted models were tested for significance as was the difference between the two predictions. The region of rejection for the null hypothesis was set at .05.

Analysis and Findings

The various research findings are summarized in two tables in order that certain comparisons may more readily be made. Table 1 records the significant predictors of SCA and SCAM scores when the subjects were grouped according to a single dichotomous variable; Table 2 lists the significant predictors when course, school size and level were controlled simultaneously.

The 32 null hypotheses were each rejected at the .05 level, and 28 of the 32 predictions actually reached significance at the .01 level. In most cases, the predictor variables accounted for 10 to 20 percent of the variance of the self-concept criterion. While it is important to recognize the probability of a chance appearance of a variable in any given equation, the results showed certain trends with seemingly important implications for educators.

In each of the six analyses for which the type of course was not controlled, this variable was a significant predictor of both SCA and SCAM scores; and the negative regression coefficient in each case indicated a weighting in favor of the algebra students. This result is compatible with the hypothesis discussed earlier that the mathematics course in which a student is enrolled may be correlated with his perception of the evaluations which others hold of him. It should be noted, however, that despite the apparent relationship between course and self-concept, in each instance where the course variable was controlled in the analysis a significant prediction still was found. Thus, variables other than course were operative as predictors of self-concepts.

The variable school size appeared as a predictor of general self-concept in five of six instances, but it did not appear at all as a predictor of mathematical self-concept. In each of the five cases involving size, the weighting was in favor of students in large schools. School level, on the other hand, appeared in the prediction equations for both SCA and SCAM measures, and each time it was weighted in favor of junior high school students. This variable was included in four predictions of SCA and in three predictions of SCAM from among the six times it was considered as a possible predictor for each criterion.

Although sex was entered as a possible predictor of SCA and SCAM scores fourteen times for each criterion, it appeared in only six regression equations, three times as a predictor of SCA and three times as a predictor of SCAM. Each weighting favored the males, but these data do not suggest a strong relationship between sex and self-concept of ability. The fifth dichotomous variable, having the teacher for a previous course, was not a significant predictor in any of the 32 cases.

Throughout the analysis the variable which appeared most frequently in the regression equations was favoritism. It appeared in each of the sixteen attempts to predict SCA and in eleven of the sixteen predictions of SCAM. Each weighting was negative and the absolute values of these regression coefficients tended to be among the greatest for the variables in the given equation.

Another variable which appeared with considerable frequency was difficulty. This scale did not appear to relate to general self-concept of ability, but it did appear as a predictor of mathematical self-concept in eleven of sixteen cases. The negative regression coefficient in each case indicated that students who perceived their mathematics classes as less difficult tended to display more positive self-concepts of ability in mathematics.

Two other environment characteristics, cliqueness and friction, likewise were important. A high cliqueness score indicates that students tend to form and work with small groups rather than to cooperate equally with all class members, while a high friction score reflects quarrels and dislikes among students, lack of cooperation and respect, and tensions which interfere with class activities. Both cliqueness and friction showed a positive relationship to self-concept criteria, possibly reflecting a relationship with the role of peers in self-concept formation.

Discussion and Implications

The present study does provide evidence for the relationship between learning environments and academic self-concepts. From a theoretical point of view, these predictive relationships gave support to the theory and rationale posited for this research effort. However, the research findings also suggest several other concerns.

First, a question arises as to whether the theories of Brookover and Walberg are, in fact, distinct. To what extent were the structural and affective dimensions of the classroom climate with which Walberg dealt coincident with the student's perceptions of the evaluations of others to which Brookover addressed himself? Or, on the other hand, if the classroom environment was truly distinct from the student's perceived evaluations of others, then the predictive relationship which was found to exist between learning environments and self-concepts of ability leads to a question about the validity of Brookover's

hypothesis that changes in the perceived evaluations of others are sufficient conditions to elicit changes in self-concepts. Both of these alternatives warrant further investigation.

The Brookover theory was based on the premise of the self-concept as a functional limit, and Brookover has repeatedly argued that low self-concepts, and not lack of ability, were the causes of many students' failure to achieve in school. If educators accept that hypothesis, then they must recognize the importance of continued effort on their part to provide opportunities for enhancing the self-concepts of learners.

An obvious problem exists for non-algebra students as indicated by the low self-concepts of members of that group. Serious consideration should be given to strategies for enhancing the academic self-concepts of these students. The result that positive self-concepts occurred more frequently among students from large schools and from junior high schools also suggests a need to investigate both the reasons for that phenomenon and the means of enhancing the self-conceptions of all students regardless of school characteristics.

Each characteristic of the learning environment merits consideration by educators, but special attention should be given to favoritism The consistent negative correlation between that variable and self-concept indicates the importance of minimizing favoritism in school classes. Strategies for recognizing favoritism and for effectively eliminating it need to be discovered, and these, in turn, should be communicated to teachers so that they may become part of the teacher's behavior pattern.

The two related characteristics, cliqueness and friction, likewise should be explored. Both characteristics are generally viewed with disfavor by educators, yet both showed positive relationships with self-concept. The question of what cliqueness means to the high school student and of how cliqueness and friction relate to the student's peer group relationships are fundamental. In addition to seeking an understanding of the nature of these classroom social forces, further research also should be designed to determine how the teacher's behavior either fosters or inhibits cliqueness and friction. Again, strategies are needed for achieving a classroom climate in which these two characteristics can be optimized.

Another area for consideration is the effect on academic self-concept brought about by changes in the learning environment. Studies should be designed in which environmental characteristics are manipulated and academic self-concepts are examined for subsequent changes. If self-concepts can be elevated in this fashion, then investigation is called for to determine if academic achievement is likewise enhanced. Additional insight into the efficacy of the learning environment as a contributor to academic self-concepts might be attained by studying the changes over time in the students' self-concepts of ability as they participate in a given class.

The present study provides evidence for the relationships between learning environments and academic self-concepts, and it has demonstrated that, for ninth grade mathematics students, both general and mathematical self-concepts of academic ability can be predicted from combinations of classroom environment characteristics. This in turn provides a rationale for additional research to determine if it is possible to enhance self-concepts through providing suitable learning environments and thereby to increase academic achievement.

Table 1

Significant Predictors of Academic Self-Concepts
of Ninth Grade Mathematics Students
with One Variable Controlled

	General Self-Concept		Mathematical Self-Concept	
	Algebra	Non-Algebra	Algebra	Non-Algebra
Grouped by Course	- Size + Level - Favoritism	- Size + Level + Sex - Cohesiveness - Favoritism + Cliqueness	+ Sex + Friction - Goal direct. - Favoritism + Cliqueness - Disorganiz. - Difficulty	+ Level - Diversity - Favoritism + Cliqueness - Difficulty
	Senior H. S.	Junior H. S.	Senior H. S.	Junior H. S.
Grouped by Level	- Course - Size + Sex - Favoritism + Cliqueness	- Course - Goal direct. - Favoritism	- Course + Sex - Favoritism + Cliqueness - Difficulty + Democracy	- Course - Favoritism - Difficulty
	Large	Small	Large	Small
Grouped by School Size	- Course - Favoritism	- Course + Level - Favoritism + Cliqueness - Apathy	- Course + Friction - Favoritism - Difficulty + Democracy	- Course + Level - Favoritism + Cliqueness
	Females	Males	Females	Males
Grouped by Sex	- Course - Size + Level - Favoritism + Cliqueness	- Course - Size - Favoritism - Disorganiz.	- Course + Level - Favoritism + Cliqueness + Satisfaction - Difficulty	- Course + Friction - Favoritism - Difficulty + Democracy

The signs in the above table indicate the sign of the corresponding regression coefficient. For dichotomous variables, positive weights favor non-algebra (+ course), junior high schools (+ level), small schools (+ size) and males (+ sex).

Table 2

Significant Predictors of Academic Self-Concepts
of Ninth Grade Mathematics Students
with Three Variables Controlled

		Senior High Schools		Junior High Schools	
		Algebra	Non-Algebra	Algebra	Non-Algebra
Large Schools	SCA	- Favoritism	+ Sex - Diversity + Friction + Goal direct. - Favoritism	- Favoritism + Cliqueness - Apathy	+ Environment + Friction - Goal direct. - Favoritism - Disorganiz. + Apathy
	SCAM	- Speed - Favoritism - Disorganiz.	+ Friction + Goal direct. + Satisfaction - Difficulty	- Difficulty - Apathy	- Diversity - Favoritism - Difficulty
Small Schools	SCA	- Goal direct. - Favoritism - Disorganiz.	+ Speed - Favoritism + Satisfaction + Disorganiz. - Apathy	- Environment + Friction - Favoritism + Satisfaction	- Favoritism + Cliqueness
	SCAM	+ Sex - Goal direct. - Favoritism + Cliqueness - Disorganiz.	+ Cohesiveness + Speed + Satisfaction - Difficulty	- Speed - Environment + Friction	- Speed + Cliqueness

The signs in the above table indicate the sign of the corresponding regression coefficient. A positive weight for the variable sex favors the males.

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